

BROOKHAVEN NATIONAL LABORATORY

OCCUPATIONAL HEALTH AND SAFETY GUIDE

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| REFRIGERATORS FOR FLAMMABLE LIQUID STORAGE | 4.12. I |
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I. INTRODUCTION

A leading cause of laboratory explosions is improper storage of flammable liquids in ordinary refrigerators. These explosions usually are caused when vapors escaping from the stored liquid containers are ignited by the sparking of ordinary electrical switches or devices in the refrigerator.

II. SCOPE

This Guide provides recommendations and requirements for the storage of flammable liquids (flashpoints below 100°F) in refrigerators and freezers and is applicable to all BNL activities.

This Guide does not apply to cold rooms, cold laboratories, walk in refrigerators or similar areas containing flammable liquids or gases, or to refrigerators installed in hazardous locations. Provisions of Occupational Health and Safety Guide 4.12.0, "Special Precautions for Locations Containing Flammable Atmospheres," apply to these areas.

III. DEFINITIONS

A. Flammable Liquid. For the purpose of this Guide only, a flammable liquid is any liquid with a flash point of 100°F (38°C) or less. Please note that other Guides combine combustible and flammable liquids into one definition of flammable liquids. This does not apply for this Guide.

B. Hazardous Location. As used in this Guide, hazardous location has the same meaning as used in the National Electric Code (NFPA 70), that is, a location in which flammable gases or vapors, or combustible dusts, exist or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Thus, the storage cabinet of a refrigerator containing a flammable liquid is itself a hazardous location. In addition, the area around a refrigerator may be a hazardous location in some cases (see Occupational Health and Safety Guide 4.12.0 for further discussion of hazardous locations).

C. "Explosionproof" Device. A device (such as a refrigerator, switch, motor, light fixture, etc.) bearing an Underwriters' Laboratories, Inc., listing mark or Factory Mutual approval mark indicating that the device has been tested with respect to safety of operation in the presence of specific flammable and explosive atmospheres.

IV. RESPONSIBILITIES

A. Department Chairmen/Division Heads or their designees (e.g. Safety Coordinators) are responsible for ensuring:

1. All existing refrigerators, within the Scope of this Guide, comply.
2. Any new purchases comply with this Guide.

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V. B. **Line Supervisors** (Facility) are responsible for the direct implementation of the provisions of this Guide. Specifically, they shall:

1. Assure that all existing refrigerators used for the storage of flammable liquids are “explosionproof” or have been modified in accordance with Section VI.
2. Make sure that all refrigerators have affixed the proper identification labels (Appendix A).
3. Make sure that all containers used for storing flammable liquids in refrigerators have tight fitting covers.

C. Safety and Environmental Protection Division is responsible for assisting in the implementation of this Guide. Specifically, the Fire Protection Engineer will review any existing equipment to ensure compliance with this Guide.

VI. REQUIREMENTS

A. Refrigerators used for the storage of flammable liquids, and not otherwise installed in a hazardous location, shall either be “explosionproof” or modified as indicated in Section VI.

Note: Ordinary refrigerators, whether or not modified in accordance with Section VI of this Guide, shall not be installed where a hazardous location exists outside the storage cabinet. Only an “explosionproof” refrigerator is satisfactory for such locations. (Further guidance on hazardous locations may be found in Occupational Health and Safety Guide 4.12.0).

B. Any ordinary refrigerator which is not “explosionproof” or has not been modified as indicated in Section VI and is located in or near a laboratory shall bear the label shown in Appendix A, Figure 3.

C. Due to the cost of modifying refrigerators, all new purchases of refrigerators for the storage of flammable liquids shall be UL or FM approved equipment.

VII. MODIFICATION OF ORDINARY REFRIGERATORS

Existing refrigerators, modified to comply with Class I Division II requirements as follows, are acceptable for storing flammable liquids:

A. The thermostat or temperature control contacts and associated relays are mounted outside the storage cabinet, with only the bulb of the thermostat inside.

B. The light and door switch are removed. An “explosionproof” light may be installed inside with the switch located outside.

C. Any electric defrosting heaters are removed or disconnected.*

D. Any air circulating fan and motor provided inside the refrigerator is removed or replaced with “explosionproof” equipment.*

E. Any other ignition sources or electrical contacts inside the cabinet (such as for making ice cubes) are removed or disconnected.

F. Any opening in the cabinet (such as around thermostatic tubing or former electrical wiring connections) is sealed gas tight.

G. All electrical equipment mounted outside of the refrigerator storage cabinet (such as motors, overload switch, compression switch, condensor fan motor, and relocated switches from the interior cabinet) is either:

1. “Explosionproof”, when located in areas such as the machine compartment at the bottom of the refrigerator, if hazardous vapors may be present due to leakage or opening of the refrigerator door; or
2. Installed above the storage cabinet or on the outside surface of the refrigerator at least 4 feet above the floor such that exposure to hazardous concentrations of vapors will be minimal.

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*Some refrigerators utilize a fan to circulate air from cooling coils located in a freezer compartment to the refrigerator compartment. Removal of the circulating fan and defrosting heaters severely degrades proper operation of the refrigerator. It is often uneconomical to modify refrigerators of this design, making them impractical for the storage of flammable liquids. Induction motor “muffin” fans with nonmetallic blades may be used in lieu of “explosionproof” fans.

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APPENDIX A

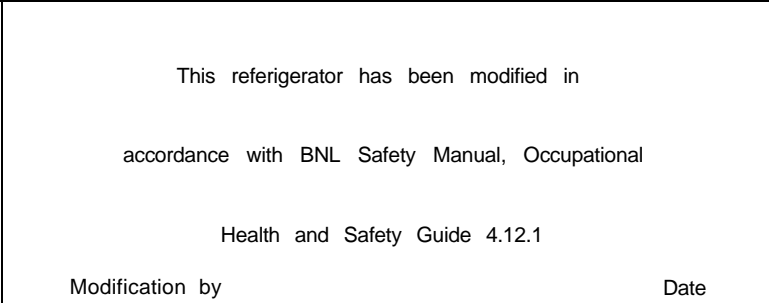
Labels

Labels are available from the
Safety & Environmental Protection Division



STORAGE OF FLAMMABLE LIQUIDS PERMITTED

Figure 1



This refrigerator has been modified in
accordance with BNL Safety Manual, Occupational
Health and Safety Guide 4.12.1
Modification by _____ Date _____

Figure 2



FLAMMABLE LIQUIDS PROHIBITED

Figure 3